WHAT IS CLAIMED IS:

1. A method for separating at least one polymer type from a starting material comprising a mixture of polyolefin plastic materials, the method comprising the steps of:

contacting the starting material with a solvent to form a solvent-plastic material mixture;

adjusting the temperature of the solvent-plastic material mixture so that a solution containing at least one dissolved polymer type is formed; and

precipitating at least one polymer type from the solution by shearing in order to separate at least one polymer type from other components of the solution.

2. The method in accordance with claim 1, wherein the method comprises at least one precipitation step which includes a first cooling step in which the solution is cooled to a transportation temperature at which no polymer is precipitated, and a subsequent cooling step in which the solution is sheared and cooled to a precipitation temperature at which the solution is separated into the polymer type and the solvent with the remaining components.

3. The method in accordance with claim 1, wherein the temperature and the ratio of the solvent to plastic material are adjusted in such a manner that at least two polymer types are dissolved in the solution.

4. The method in accordance with claim 1, wherein the temperature of the solution is adjusted in such a manner that at least two liquid phases are formed, each of which contains at least one polymer type in a concentration higher than in other liquid phases.

5. The method in accordance with claim 4, wherein the at least two liquid phases are separated.

6. The method in accordance with claim 5, wherein at least one polymer type is present in one of the separated phases in a concentration higher than in other phases and is precipitated by shearing.

7. The method in accordance with claim 4, wherein the mixture of polyolefin plastic materials comprises polyethylene and polypropylene, and the temperature of the solution is adjusted in such a manner that at least one upper liquid phase and at least one lower liquid phase are formed, in which the at least one upper phase is polypropylene-rich, having a polypropylene concentration that is higher than the polypropylene concentration in the at least one lower phase, and the at least one lower phase is polyethylene-rich, having a polyethylene concentration that is higher than the polyethylene concentration in the at least one upper phase.

8. The method in accordance with claim 6, wherein the formation and separation of the at least two liquid phases occur prior or subsequent to at least one polymer type being sheared and precipitated from the solution.

9. The method in accordance claim 1, wherein the method comprises at least two precipitation steps, each of which is conducted at a precipitation temperature at which one polymer type is precipitated.

10. The method in accordance with claim 9, wherein the number of precipitation steps corresponds to the number of dissolved polymer types.

11. The method in accordance with claim 10, wherein the solution in a first precipitation step is cooled to a first precipitation temperature at which essentially only a single polymer type is precipitated, this first polymer type is separated from the solution, and the remaining solution is cooled to a second lower precipitation temperature at which at least a second polymer type is precipitated in a second precipitation step.

12. The method in accordance with claim 11, wherein the second polymer type is separated from the solution, and the remaining solution is cooled to a third precipitation

temperature which is lower than the second precipitation temperature and at which at least a third polymer type is precipitated in a third precipitation step.

13. The method in accordance with claim 12, wherein the first polymer type consists essentially of high density polyethylene, the second polymer type consists essentially of polypropylene and the third polymer type consists essentially of low density polyethylene.

14. The method in accordance with claim 12, wherein the first polymer type consists essentially of polypropylene, the second polymer type consists essentially of high density polyethylene, and the third polymer type consists essentially of low density polyethylene.

15. The method in accordance with claim 12, wherein after the precipitation of each single polymer type, the resulting suspension is exposed to a solid-liquid separation and the remaining solution is led to the next precipitation step.

16. The method in accordance with claim 7, wherein the separation of phases is carried out in a centrifuge, and the temperature of the solution in the centrifuge is adjusted in such a manner that an upper and a lower liquid phase is formed, which can be separated.

17. The method in accordance with claim 16, wherein the polypropylene-rich phase is fed to a first precipitation step in which polypropylene is precipitated by shearing at a first precipitation temperature; the polyethylene-rich phase is fed to a second precipitation step in which high density polyethylene is precipitated by shearing at a second precipitation temperature and high density polyethylene is isolated from the solution; and low density polyethylene is precipitated by shearing in a third precipitation step at a third precipitation temperature that is lower than the second precipitation temperature.

18. The method in accordance with claim 7, wherein dissolved polypropylene and high density polyethylene are each precipitated from the solution by shearing at a precipitation temperature.

19. The method in accordance with claim 18, wherein the precipitation results in a suspension, which undergoes a solid/liquid separation to separate the polypropylene or high density polyethylene from the solution.

20. The method in accordance with claim 19, wherein, after separation of at least one of polypropylene and high density polyethylene, low density polyethylene is recovered from the solution using either shearing or solvent evaporation.

21. The method in accordance with claim 19, wherein the precipitation and separation of the polypropylene and the high density polyethylene are repeated.

22. The method in accordance with claim 4, wherein the at least two liquid phases are immiscible and are separated using a separation funnel, a centrifuge or a coalescence separator.

23. The method in accordance with claim 1, wherein the solution is cleaned to remove one or more of impurities, additives, coloring agents, undissolved plastic material and heavy materials in a solid-liquid separation step prior to the shearing and precipitation.

24. The method in accordance with claim 1, wherein each polymer type precipitated from the solution is cleaned in at least one washing step using solid-liquid separation.

25. The method in accordance with claim 1, wherein each polymer type is recovered from solution using sequential degassing extrusion.

26. The method in accordance with claim 1, wherein low molecular weight polymer fragments and waxes dissolved in the solution are recovered using solution distillation.

27. The method in accordance with claim 1, wherein the solution is mechanically cleaned of insoluble materials.

28. The method in accordance with claim 1, wherein the starting material comprises a blend of one or more polyolefin polymers selected from polypropylene, high density polyethylene and low density polyethylene and further comprises other polymer impurities.

29. The method in accordance with claim 24, wherein following the washing step, a precipitated polymer type is dissolved again and is recovered as a powder having a desired range of particles sizes using conventional precipitation with an organic precipitation agent.

30. The method in accordance with claim 1, wherein an organic solvent is used.

31. The method in accordance with claim 1, wherein the solvent is selected from the group consisting of petroleum spirits, hexane, decalin and xylene.

32. The method in accordance claim 1, wherein the dissolving temperature for the solvent-plastic material mixture is higher than 100° C.

33. The method in accordance with claim 12, wherein the first precipitation temperature is in the range 85°-130°C, the second precipitation temperature is in the range 70°-105°C, and the third precipitation temperature is in the range 50-80°C, whereby the difference between each successive precipitation temperature is at least 2°C.

34. The method in accordance with claim 1, wherein the precipitation is carried out by passing the solution through a shearing gap of a precipitation shearing device.

35. The method in accordance with claim 1, wherein the precipitation is carried out in a precipitation heating vessel fitted with a multi-stage impulse counter-flow mixer, the blades of which have sufficient shearing to generate a fibrous product.

36. The method in accordance with claim 1, wherein the precipitation is carried out by cooling the solution and feeding a sufficient amount of cooled solution from a precipitation heating vessel into an external shearing apparatus with a shearing gap.

37. The method in accordance with claim 36, wherein the shearing apparatus has an adjustable circumferential speed and can be adjusted for batch or continuous operation.

38. The method in accordance with claim 1, wherein the starting material comprises used plastic material.

39. The method in accordance with claim 1, wherein the starting material is brought into contact with a first solvent at elevated temperature and ambient pressure to form a first solution, the first solution is cleaned to remove insoluble compounds, and the first solvent is then replaced with a second solvent to form a second solution.

40. The method in accordance with claim 39, wherein the first solution is cleaned using filtration, decanting or centrifuging.

41. The method in accordance with claim 1, wherein additives that are soluble in or miscible with the at least one polymer type are added to the solution prior to shearing and precipitation.

42. A product made from a polymer which has been separated in accordance with the method of claim 1.

43. A product in accordance with claim 42, wherein the polymer has a purity of at least 90% by weight and any insoluble or difficult to dissolve foreign polymers contained within the polymer represent less than 3% by weight of the content of such polymer type.

44. A polypropylene blend generated by the method in accordance with claim 1, wherein the blend has a polypropylene content of more than 90% by weight, and contains a

maximum of 0.5% by weight of each polyethylene terephthalate and polystyrene and a maximum of 10% by weight of polyethylene, the largest share of which is low density polyethylene.

45. A polypropylene blend in accordance with claim 44, having the following mechanical characteristics:

- Yield stress ≥ 30 Mpa
- Strain ≥ 8%
- Elastic modulus ≥ 1000; and
- Charpy impact resistance ≥ 4 Mpa.

46. A polyethylene blend comprising low density polyethylene and high density polyethylene generated by the method in accordance with claim 1, wherein the blend contains (a) at least 97% by weight polyethylene, of which at least 10% by weight is high density polyethylene and at least 10% by weight is low density polyethylene; (b) a maximum of 3% by weight of polypropylene; and (c) less than 1% by weight of each polystyrene and polyethylene terephthalate; and wherein the starting material comprises post-consumer plastic waste material.

47. A high density polyethylene blend generated by the method in accordance with claim 1, wherein the blend contains at least 95% by weight high density polyethylene, a maximum of 3% by weight of polypropylene, a maximum of 5% by weight of low density polyethylene, and less than 1% by weight of each polyethylene terephthalate and polystyrene, and wherein the starting material comprises post-consumer plastic waste material.

48. A low density polyethylene blend generated by the method in accordance with claim 1, wherein the blend contains at least 95% by weight low density polyethylene, a maximum of 3% by weight of polypropylene, a maximum of 5% by weight of high density

polyethylene, and less than 1% by weight of each polyethylene terephthalate and polystyrene, and wherein the starting material comprises post-consumer plastic waste material.

49. A polymer blend generated by the method in accordance with claim 1, wherein the blend comprises: (a) at least 70% by weight of a first polyolefin selected from the group consisting of polypropylene, low density polyethylene, and high density polyethylene; (b) a maximum of 5% by weight of each of two polyolefins selected from said group other than said first polyolefin; and (c) a maximum of 20% by weight of a fourth polymer component, which was added and precipitated from the solution.

50. A method for separating at least one polyolefin from a starting material comprising a mixture of two or more polyolefins selected from the group consisting of polypropylene, low density polyethylene and high density polyethylene, the method comprising the steps of:

mixing the starting material with a solvent and adjusting the temperature of the mixture to form a solution containing at least one dissolved polyolefin;

adjusting the temperature of the solution so that at least two liquid phases are formed, each of which contains one dissolved polyolefin in a higher concentration than in each of the other liquid phases;

separating one liquid phase from the other liquid phases;

precipitating one polyolefin from the separated liquid phase by shearing the solution at a temperature sufficient to cause the polyolefin to precipitate; and

separating the precipitated polyolefin from the solution.